

# Solutions to Quizzes

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## Quiz 13:

Derive the above m.f. for  
 $X \sim N(\mu, \sigma^2)$  and  $X \sim B(1, p)$

## Solution to Quiz 13

- For continuous r.v.  $X \in \mathbb{R}$ , moment generating function is  $M_X(t) = E[e^{tX}] = \int_{-\infty}^{\infty} e^{tx} f(x) dx$ :  
Therefore for  $X \sim N(\mu, \sigma^2)$ , we have

$$\begin{aligned} M_X(t) = E[e^{tX}] &= \int_{-\infty}^{\infty} e^{tx} \cdot \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}} dx \\ &= \int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{[x-(\mu+t\sigma^2)]^2}{2\sigma^2}} \cdot e^{(t\mu+t^2\sigma^2/2)} dx \\ &= 1 \cdot \exp(t\mu + t^2\sigma^2/2) = \exp(t\mu + t^2\sigma^2/2) \end{aligned}$$



## Solution to Quiz 13

- For discrete  $r.v. X \in \mathbb{Z}$ , moment generating function is

$$M_X(t) = \sum_i e^{tx_i} \cdot p_i$$

Therefore for  $X \sim B(1, p)$ , we have

$$M_X(t) = e^{t \cdot 0} \cdot (1 - p) + e^{t \cdot 1} \cdot p = 1 - p + pe^t$$

